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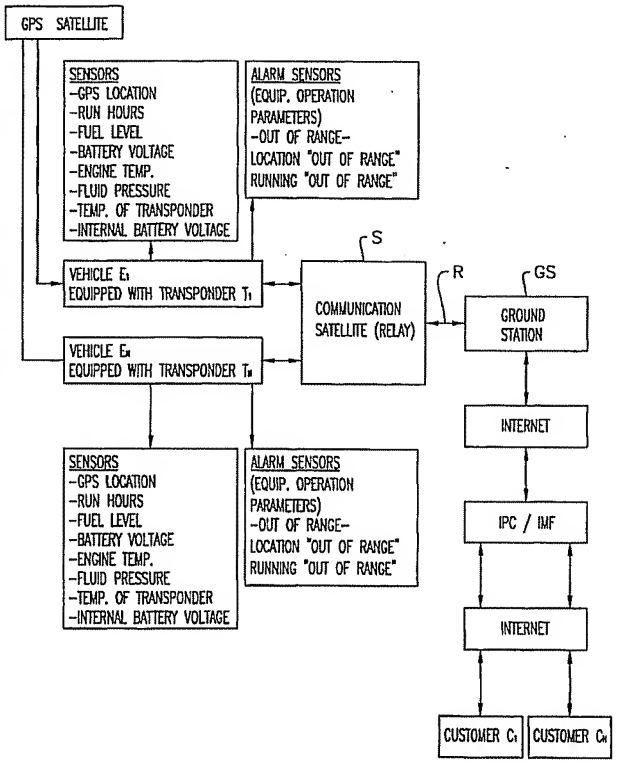
(54) Title: A SYSTEM FOR REMOTE VEHICLE TRACKING



(57) Abstract: A novel method of and system for remotely monitoring location, status, utilization and condition of a widely geographically dispersed fleets of vehicle construction equipment, using the resources of satellite positioning and communication and Internet facilities, and processing and displaying such information for fleet managers and the like.

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A SYSTEM FOR REMOTE VEHICLE TRACKING

Field of Invention

The present invention is broadly concerned with keeping track of the location, status, degree of utilization and condition and operability of widely geographically dispersed fleets of vehicular construction equipment and the like, using the resources of satellite positioning and communication Internet facilities; the invention being more particularly concerned with providing the fleet owner with the capability of utilizing such information, suitably processed, on periodically provided schedule, or upon specific request to monitor and improve fleet utilization, efficiency, and cost-effectiveness.

Background

It has previously been proposed to keep track of vehicular construction equipment and the like by providing the vehicles with transponders receiving GPS location information and supplying the same via an Internet web page, or otherwise, to the equipment owner. Currently, for example, transponder and communications link equipment for effecting such operation is offered by Orbcomm USA limited partnership company, of the satellite provider orbital Sciences Corp. The Caterpillar Company is also believed similarly to monitor such information and, through appropriate sensor(s) at the equipment, indicating also such utilization information as run-time to enable the timely Orbcomm offering of spare parts.

enable the customer to request of the headquarters a special report at any time (a so-called-interrogation or express-inquiry mode), wherein a headquarters center requests the ground station to send a signal to the satellite to trigger the transponder for such a special report. And, as earlier mentioned, the invention may further provide operation in an alarm mode, sensitive to unauthorized conditions, such as the moving or use of the equipment after hours or at another site, and the like, and triggering the transponders.

Thus, while not a real-time tracking system, the system of the invention can adequately provide the fleet manager with all the basic information needed remotely to track and monitor the operation of the fleet and to improve efficiency of equipment utilization and operation. In addition, the facility is provided for the manager to select or request different options on limits or information parameters or items for selective display, and such may be discriminatingly color-coded on the display.

Objects of Invention

The primary object of the present invention, accordingly, is to provide a new and improved method of and system and apparatus for remotely monitoring several or all of the location, status, utilization and condition of widely geographically dispersed fleets of vehicular construction equipment and the like, providing, unlike previous satellite-transponder systems before-described, totally adequate and processed signal information for enabling the continual improving of the efficiency and economic return on the utilization of the equipment by managers monitoring user-friendly displays.

satellites information as to its location and as to said locally sensed data; relaying said information from the communications satellite to a ground station and thence, via the Internet, to said center; signal-processing the related information at the center to adapt it for one or more of graphical and tabular location display of the widely dispersed equipments and/or of optionally selected equipments, and optionally selected parameters, limits and conditions of such equipments, to provide processed information suitable to exercise management analysis of equipment utilization and operational efficiency; and communicating such processed information to the fleet manager for enabling improving said efficiency of utilization and operation.

Novel fuel monitoring and special item option color display features are also involved.

Preferred and best mode embodiments and designs are hereinafter disclosed and detailed in connection with the description of the operation of the system.

Drawings

The invention will now be described in connection with the accompanying drawings, Fig. 1 of which is a schematic representation of the overall system of the invention in preferred form;

Fig. 2 shows typical equipment-monitoring processed data supplied to customers in various display formats;

Fig. 3 is a representation of the dialog used to set different data display colors and the breakpoints therefor; and

communications satellite S information as to its location and as to this locally sensed data. The satellite S, in turn, relays this information, as at R, from the satellite to the ground station GS and thence, as before stated, via the Internet to the center IPC (IMF), where signal-processing means at the center adapts or conditions the relayed information for one or more of geographical and tabular location display of the widely dispersed equipments and / or for optionally selected equipments, and optionally selected parameters, limits and conditions of such equipments, to provide processed information suitable to exercise management analysis of equipment utilization and operational efficiency - - communicated, again over the Internet or otherwise, to the fleet manager customers C_1 ... C_N for enabling improving said efficiency of utilization and operation.

Examples of such software-implemented display are shown in Fig. 2 wherein equipment type-make-model-user and location are tabularly presented at TD, geographical distribution at G, and run hours and hours to maintainence presented at M, providing interactive maps and reports in, for example, an illustrative Windows environment, based on the continuing flow of processed information.

In accordance with a preferred embodiment of the invention, means is provided for displaying the selected equipments and/or selected parameters and conditions thereof, etc. in different distinctive colors. In the representation of Fig. 3, there is presented a typical dialog used in accordance with the invention to set the color in accordance with data breakpoints for different color presentations. For each of the parameters (56 day average, 28 day average, as illustrated etc.) the breakpoint between "low" and "medium" and the breakpoint between "medium" and "high" are set. The medium color may be yellow. The other two colors are red (R) and blue (B). The third column on the dialog

milliamps, occurring in a couple of hundred milliseconds, and then shutting off the transponder powering. The circuit thus uses very little power when it is not sensing and, by careful design, minimizes the power needed when it is sensing.

Details of a preferred design are shown in the block and circuit diagram of Fig. 4 which enables measuring the fuel level even when the equipment is not running (i.e. no power from the equipment), and on equipment in which the "master cutoff" switch disconnects the battery negative from the chassis or ground, causing the before-discussed fuel level sensor to "float". In order to satisfy the previously described goal of minimal power usage, the control processor 2 only turns on the circuits when a reading is to be taken -- illustrated by the dash lines. The line 2' to the selector 4 controls a switch, which determines whether the fuel level sendor 6 is connected to the equipment fuel gauge (so-labeled and representing normal operation), or the before-described fuel sensor reading (usually less than 1 second).

The basic concept of the circuit is that power is momentarily supplied to the sensor 8 through the transformer T, which provides isolation. The level may be read by sensing back through the transformer or by using opto-isolators 12. When it is desired to take a reading, the control processor 2 turns on the power source 10 and switches the selector 4 to the fuel sender reader 8. The signal is sent for the isolation circuit 12 and then "conditioned" at 14 (e.g. amplified, linearized), and applied to the control processor 2 where it can be saved. The control processor generates an output signal which is again conditioned at 16 and sent to the satellite transponder, so-labeled.

This circuit can operate in two ways. First, when the satellite transponder wants to transmit the value, it sends a signal to the control processor, which goes through the

Further modifications will also occurred to those skilled in this art and such are considered to fall within the spirit and scope of the invention as defined in the appended claims.

2. The method of claim 1 wherein the selected equipments and selected parameters and conditions thereof are distinctively displayed in different colors.

3. The method of claim 1 wherein said communicating is effected over the Internet.

4. The method of claim 1 wherein the fuel level sensing is effected both when the equipment engine is running and when it is shut down.

5. The method of claim 1 wherein the transponders are operated periodically to provide a standard mode reporting schedule.

6. The method of claim 5 wherein such schedule is set for daily or several day reporting.

7. The method of claim 1 wherein, upon special request, a signal is sent to the satellite specially to interrogate the transponders.

8. The method of claim 1 wherein, upon sensing unsafe and/or unauthorized action at the transponders, they are activated in an alarm mode to notify the center.

9. The method of claim 8 wherein included in such unauthorized action are after-hours and off-site equipment use.

13. The apparatus of claim 10 wherein the sensor of the fuel level is operable either or both when the equipment engine is running and when it is shut down.

14. The apparatus of claim 10 wherein means is provided for operating the transponders periodically to provide a standard mode reporting schedule.

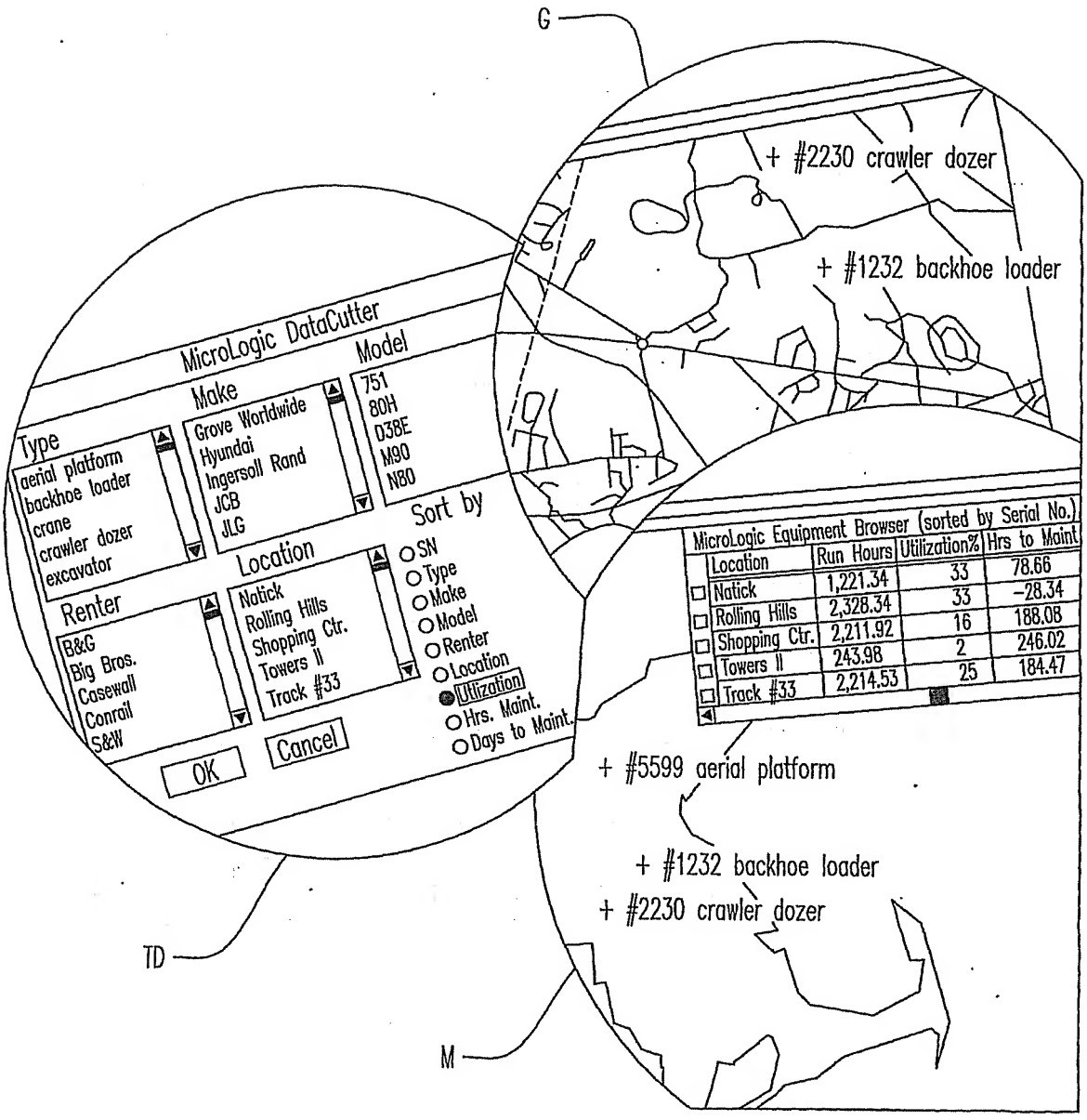
15. The apparatus of claimed 14 wherein such schedule is set for daily or several day reporting.

16. The apparatus of claim 10 wherein, means is provided, operable upon special request, to send a signal to the satellite specially to interrogate the transponders.

17. The apparatus of claim 10 wherein there is provided means for sensing unsafe and/or unauthorized action at the transponders, activated in an alarm mode so as to notify the center.

18. The apparatus of claim 17 wherein included in such unauthorized action are after-hours and off-site equipment use.

19. The apparatus of claim 13 wherein, when the engine is shut down, the fuel level sensor is at floating potential, and isolation transformer means is provided for momentarily energizing the fuel level sensor.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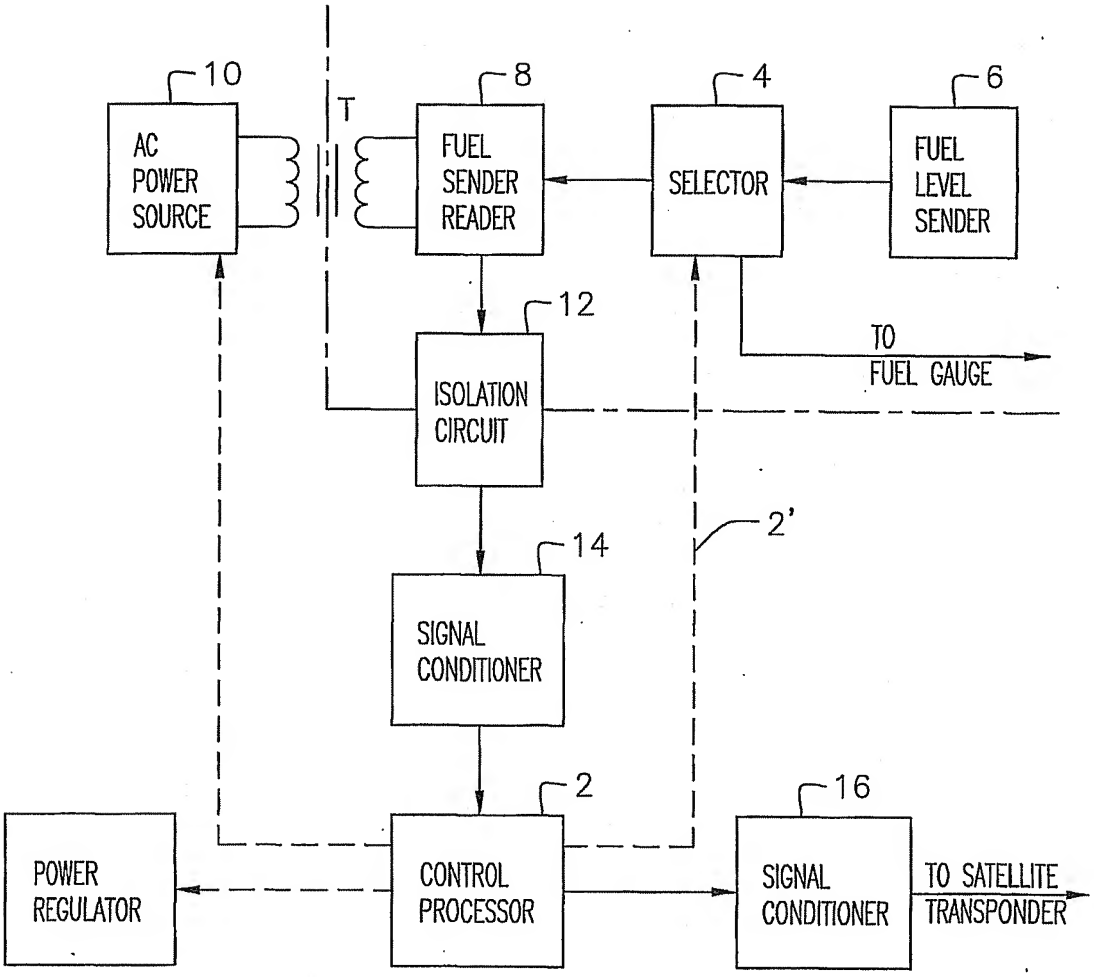
+ #2230 crawler dozer
TD
M

FIG. 2



Isolated Ciruit

(Note: Control lines are dotted.)

FIG. 4

INTERNATIONAL SEARCH REPORT

Information on patent family members

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